PATENT ABSTRACTS OF JAPAN

(11)Publication number : 11-347516

(43)Date of publication of application : 21.12.1999

(51)Int.Cl. B09B 3/00
B09B 3/00
// C04B 7/19

(21)Application number : 10-162180

(22)Date of filing : 10.06.1998

(71)Applicant : JGC CORP

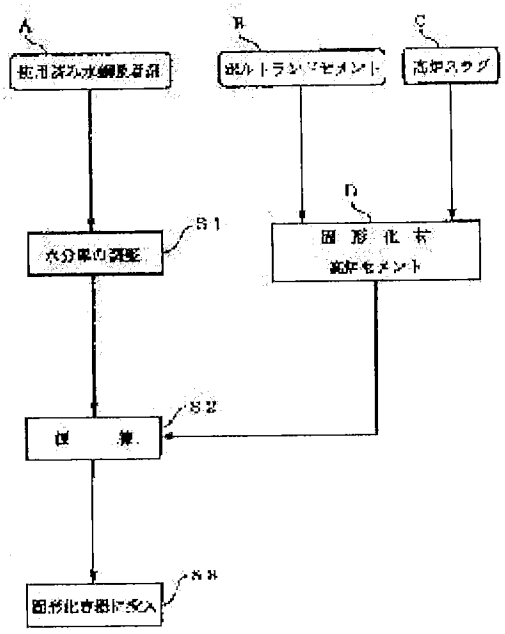
(72)Inventor : FUJIMURA YASUSHI
SASAKI TADASHI
YAMADA MASATOSHI
SATO KAZUO

(54) METHOD FOR SOLIDIFICATION TREATMENT OF USED MERCURY ADSORBENT

(57)Abstract:

PROBLEM TO BE SOLVED: To solidify a used mercury adsorbent in a stabilized state by solidifying a used mercury adsorbent having adsorbed mercury, using a solidifying material composed of a mixture of Portland cement with blastfurance slag.

SOLUTION: In the case of solidification treatment of a used mercury adsorbent A having been used in an adsorption removal treatment process of mercury in a natural gas condensate, at first a water content rate of the used mercury adsorbent A is adjusted. In the case where the mercury adsorbent A is dry in this case, a specific amount of water is added, and further when the mercury adsorbent A is dipped in water, draining is executed. Then, a solidifying material D prepared by mixing a granulated blast furnace slag C, a Portland cement B or a previously prepared blast furnace cement D as the solidifying material is added to the marcury adsorbent A, and kneaded. After kneading, the kneaded material is charged into a solidification container and allowed to make a solidified material by curing for about one month. Further, a formulation ratio of the blastfurnace slag C and the Portland cement B is preferably in the range of 10/90 to 80/20 in wt. ratio.



* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1]A solidification method of used mercury adsorbent carrying out solidification of the used mercury adsorbent which adsorbed mercury using a solidifying material which mixes portland cement and blast furnace slag.
[Claim 2]A solidification method of the used mercury adsorbent according to claim 1 making into the range of 10 / 90 - 80/20 a blending ratio of blast furnace slag and portland cement which constitute a solidifying material by a weight ratio.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]In this invention, it is related with the solidification method of used mercury adsorbent.
In detail Therefore, gaseous hydrocarbon, such as natural gas, or LNG (liquefied natural gas),It is related with the solidification method of the used mercury adsorbent used for the adsorption treatment treatment process of mercury in liquid hydrocarbon, such as NGL (natural gas liquid), kerosene, gas oil, gasoline, and naphtha, especially a natural GASUKONDENSE rate.

[0002]
[Description of the Prior Art]The mercury contained in natural gas, a natural gas liquid (NGL), etc. has a problem of the corrosion of a heat exchanger made of aluminum, and the performance degradation of a catalyst.
[0003]Then, the art which carries out adsorption treatment of the mercury contained in natural gas, a natural gas liquid, etc. using mercury adsorbent is provided.
[0004]In mercury adsorbent, it is alumina support. There are nickel (nickel), Co (cobalt), a thing that added Mo (molybdenum) sulfide, a thing which comprises an activated carbon independent, a thing which supported a sulfuration alkaline metal and sulfuration alkaline-earth metals to the activated carbon simple substance further, etc.
[0005]On the other hand, since mercury adsorbent after adsorbing mercury is the obnoxious waste having contained mercury, it must be processed by a safe method. After also driving out used mercury adsorbent as mercury vapour with heating, the method of making condense and processing as metal mercury is safe for it. [as well as a dry cell, a fluorescent lamp, etc.] However, even if Japan does not have small deer disposal equipment and it sees globally, there are few the numbers and there are especially in Southeast Asia. [no] This is because the operation management of equipment is [that disposal equipment is expensive and] difficult. The method of solidifying into cement etc. and disposing of appropriately as what is replaced with this method, is mentioned.
[0006]
[Problem(s) to be Solved by the Invention]by the way, common poisonous metal -- for example, -- Some methods of carrying out cement solidification processing of Cd (cadmium), Pb (lead), Hg (mercury), the Cr (chromium), etc. are proposed.
[0007]For example, Provisional Publication No. In No. 133578 [53 to] ("solidifying method by cement of chromic compound content waste"). By carrying out addition mixing of hydraulic cement, blast furnace slag powder, ferrous sulfate, or the ferrous chloride, even after hydration of cement advances, the art of acquiring the cement solidification object which is not put to acid conditions and was excellent in airtightness and watertightness is indicated.
[0008]Publication number In No. 10739 [eight to] ("waste treatment material and waste disposal

method"). The burned ash waste containing poisonous metal, such as mercury, lead, and cadmium, an acid earth, The art which carries out solidification by bentonite, kaolin, aluminum sulfate, aluminium silicate, the solid acid of a silicon dioxide or this solid acid, cement, and the thing that added the anti-caking agent to this further is indicated considering the elution prevention art of Pb as a center.

[0009]However, since it was an inorganic compound and an organic compound, in order to have processed used mercury adsorbent stably, the conventional cement solidification processing of the chemical form voice of the mercury by which used mercury adsorbent was adsorbed was insufficient.

[0010]That is, in used mercury adsorbent, mercury is adsorbed mainly with the gestalt of mercury sulfide, and while this mercury sulfide is insolubility and has stable character to water, in an oxidizing atmosphere, it shows the character which oxidizes to sulfate and is eluted easily.

[0011]Since a kind of mercury adsorbent has the character which reacts to alkali and is dissolved under a strong-base condition, When the ordinary portland cement in which strong alkali is shown according to a solidification process, and the alkali stimulus solidifying material which uses sodium hydroxide as a stimulant are used, and mercury adsorbent dissolves in a solidification process, there is inconvenience that solidification is checked and intensity is not revealed.

[0012]It is in the purpose of this invention providing the solidification method of used mercury adsorbent which can carry out solidification of the used mercury adsorbent which adsorbed mercury in the state where it was stabilized, in view of the above-mentioned actual condition.

[0013]

[Means for Solving the Problem]There are few alkali yields produced in a solidification process, and a solidifying material which has the capability to stabilize mercury sulfide because the solidifying material itself shows reduction nature is ideal for controlling a problem in cement solidification processing of the **** former mentioned above.

[0014]An artificer of this application found out that what is called blast furnace cement that mixes portland cement and blast furnace slag was the optimal as a solidifying material with which it is satisfied of conditions like ****.

[0015]So, in a solidification method of used mercury adsorbent in connection with this invention, solidification of the used mercury adsorbent which adsorbed mercury is carried out using a solidifying material which mixes portland cement and blast furnace slag in order to attain the above-mentioned purpose.

[0016]

[Embodiment of the Invention]Drawing 1 shows the example which applied the solidification method of the used mercury adsorbent in connection with this invention to the adsorption treatment treatment process which removes mercury out of a natural GASUKONDENSE rate (NGL).

[0017]As shown in drawing 1, the solidification of used mercury adsorbent includes the process (S2) of kneading the process (S1) of adjusting the moisture regain of used mercury adsorbent, and used mercury adsorbent and a solidifying material, and the process (S2) of feeding the kneaded material of used mercury adsorbent and a solidifying material into a solidification container.

[0018]In order to carry out solidification of the used mercury adsorbent like ****, the moisture regain of the used mercury adsorbent A is adjusted first (S1). The "mercury adsorbent" under following explanation shall point out "used mercury adsorbent."

[0019]Here, when the mercury adsorbent A is dry, the water of the specified quantity is added to this mercury adsorbent A, and when the mercury adsorbent A is immersed in water, the moisture regain of the mercury adsorbent A is adjusted by draining off water to the mercury adsorbent A. At the time of adjustment of this moisture regain, the mercury adsorbent A may still be the fabricated gestalt, or may be ground.

[0020]After adjusting the moisture regain of the mercury adsorbent A, in addition to the mercury adsorbent A with which moisture regain was adjusted, blast furnace cement D as the solidifying

material D which mixes blast-furnace-slag B and the portland cement C, or a solidifying material prepared beforehand is kneaded (S2).
[0021]When mixing the solidifying material D with the mercury adsorbent A, the mercury adsorbent A with which moisture regain was adjusted to the cement base (solidifying material) D which added, kneaded and prepared water to the solidifying material D which mixes blast-furnace-slag B and the portland cement C, or blast furnace cement may be added.
[0022]After kneading the mercury adsorbent A and the solidifying material (blast furnace cement) D, this kneaded material is fed into the solidification container (not shown) of specified shape (S3). After this, by recuperating oneself about one month, solidification of the mercury adsorbent A will be carried out because the mercury adsorbent A and kneaded material with the solidifying material D change with a solidified body.
[0023]As stated also in advance, mercury adsorbent adsorbs mercury as mercury sulfide here, As a method of solidifying so that elution of mercury from hydrogen adsorbent may be controlled and disposal may be suited, application of the cement solidification material which blended blast furnace slag is the optimal, without having the capability to insolubilize and spoiling this capability.
[0024]By namely, the thing for which mercury adsorbent is solidified with the cement which iron and the sulfur component which show reduction nature contain in blast furnace slag, and blended blast furnace slag. Since mercury adsorbent can be solidified in reducing atmosphere, it becomes possible to fix stably with the gestalt of mercury sulfide which is an adsorption gestalt of mercury.
[0025]The mercury adsorbent containing nickel, Co, and Mo, When the solidifying material which generates a lot of [since nickel etc. dissolve under a strong-base condition / when solidifying like portland cement] calcium hydroxide is used, Solidification of cement is checked with the metal which the mercury fixed performance which some mercury adsorbent dissolves and mercury adsorbent has was spoiled, and dissolved. In order to suppress the dissolution of such mercury adsorbent and to generate a stable solidified body, an alkaline low solidifying material is suitable and the cement solidification material which contains blast furnace slag so much is suitable as an alkaline low solidifying material.
[0026]Therefore, according to the fixing method of the used mercury adsorbent in connection with this invention which carries out solidification of the mercury adsorbent using the solidifying material which mixes portland cement and blast furnace slag as mentioned above. It becomes possible to fix used mercury adsorbent in the state where it was stabilized, without causing the insufficient strength of unprepared elution of mercury, or a solidified body, since the thing which fix stably the mercury by which mercury adsorbent was adsorbed and for which solidification of a solidifying material is prevented from alkaline lowness while being able to carry out things can be suppressed.
[0027]Since the solidifying material which mixes portland cement and blast furnace slag is generally cheaply marketed as blast furnace cement and can be easily obtained not only in the inside of Japan but in every country in the world, it becomes possible to carry out solidification of the used mercury adsorbent simple and cheaply.
[0028]In the fixing method of the used mercury adsorbent in connection with this invention, the main work, In order to mix [very easy] used mercury adsorbent, a solidifying material, and water, it becomes possible to carry out solidification of the used mercury adsorbent very easily into the petroleum plant which used mercury adsorbent generates.
[0029]Table 1 indicated to drawing 2 expresses the result of having carried out the elution test, to the solidified body created using various kinds of solidifying materials.
[0030]the so-called pellet of the nickel-Cr-MoX catalyst which made the gamma alumina carrier support nickel, Cr, and Mo sulfide with this examination -- mercury 0.8 wt% -- the thing made to adsorb is made into the sample of mercury adsorbent.
[0031]The comparative examination is carried out about three sorts of solidified bodies and the mercury adsorbent simple substance which were created using these solidifying materials, using an ordinary-portland-cement and blast furnace cement C kind equivalent (portland cement/blast

furnace slag = 35/65 wt%) and slag cement as a solidifying material.
[0032]Each solidified body is mercury adsorbent. It is water to 5 g. 9.2 g, solidifying material After adding 17.9 g and mixing, this was supplied to the solidification container, and in the room temperature, care of health was performed for one month, and it created. In using slag cement as a solidifying material, it has also added the sodium hydroxide solution as a hardening agent.
[0033]The elution test was carried out according to the "assaying method of metal etc. which are contained in industrial waste" Environment-Protection-Agency notification No. (February, Showa 48) 13. That is, a sample is extracted from liquid after grinding the created solidified body and shaking in weak chloride aqueous acids for ordinary temperature 6 hours, and this sample is quantified by hydride generation atomic absorption spectrophotometry.
[0034]The solidified body using blast furnace cement as a solidifying material has the low mercury concentration in an eluate compared with a mercury adsorbent simple substance, and it is clear from the test result of Table 1 that its elution of mercury is controlled by solidification.
[0035]On the other hand, in the solidified body using portland cement as a solidifying material, and the solidified body using slag cement as a solidifying material, the phenomenon in which elution of mercury will be promoted conversely is seen compared with a mercury adsorbent simple substance.
[0036]On the other hand, it turns out that the oxidation-reduction potential of the eluate shows the low value in the solidified body which used blast furnace cement and slag cement as the solidifying material, and these solidified bodies show reduction nature.
[0037]However, although the solidified body which used slag cement as the solidifying material has a low oxidation-reduction potential, since the sodium hydroxide solution is added as a hardening agent, the dissolution of mercury adsorbent arises, and it does not solidify thoroughly, but, therefore, the elution depressor effect of mercury will become small.
[0038]When used mercury adsorbent is fixed from this result, controlling elution of mercury effectively, it turns out that use of the solidifying material which blends portland cement and blast furnace slag is the optimal.
[0039]Table 2 indicated to drawing 3 expresses the result of having carried out the elution test, to the solidified body created using the various solidifying materials which changed the mixture ratio of portland cement and blast furnace slag.
[0040]In this examination, the chemical form voice of the mercury by which mercury adsorbent was adsorbed is imitated, and the powder of mercury sulfide is used as a sample.
[0041]What mixed three sorts of blast furnace slag from which a maker differs, and portland cement by various kinds of weight ratios of 5/95, 10/90, 20/80, 40/60, 65/35, and 80/20 is used as a solidifying material.
[0042]In a solidified body and water of 14.3 g A 35.7-g solidifying material is added, and it mixes, and is this. After adding 0.058-g mercury sulfide powder and mixing, it is creating by supplying to a solidification container and recuperating oneself.
[0043]According to the "assaying method of metal etc. which are contained in industrial waste" Environment-Protection-Agency notification No. (February, Showa 48) 13, an elution test as well as the examination which showed the result in Table 1, A sample is extracted from liquid after grinding the created solidified body and shaking in weak chloride aqueous acids for ordinary temperature 6 hours, and this sample is quantified by hydride generation atomic absorption spectrophotometry.
[0044]The mercury concentration in the eluate in each solidified body is not based on the difference in the maker of blast furnace slag, but shows the almost same measured value so that clearly from Table 2. It turns out that it is what is revealed based on the physical properties with which the fixed effect of mercury in the solidifying material having contained blast furnace slag is not based on a specific kind of blast furnace slag, and blast furnace slag is generally provided from this.
[0045]When the blending ratio of blast furnace slag to portland cement uses a low solidifying material, Although the tendency for the elution volume of mercury to increase is seen, the blending ratio of blast furnace slag and portland cement is a weight ratio. In 10/90 - 80/20, the elution

volume of mercury shows the low value.
[0046]As a result, when used mercury adsorbent is fixed controlling elution of mercury effectively, the blending ratio of blast furnace slag and portland cement is a weight ratio. It turns out that the solidifying material in the range of 10 / 90 - 80/20 can be used.
[0047]The solidification method of the mercury adsorbent in connection with this invention, Only not only in the adsorption treatment treatment process which removes mercury out of a natural GASUKONDENSE rate (NGL), Also when removing mercury out of liquid hydrocarbon, such as gaseous hydrocarbon, such as natural gas, LNG (liquefied natural gas), kerosene, gas oil, gasoline, naphtha, it cannot be overemphasized that it can apply very effectively.
[0048]
[Effect of the Invention]As mentioned above, as explained in full detail, in the solidification method of the used mercury adsorbent in connection with this invention, solidification of the used mercury adsorbent which adsorbed mercury is carried out using the solidifying material which mixes portland cement and blast furnace slag.
[0049]according to the fixing method of the used mercury adsorbent in connection with this invention, the mercury by which mercury adsorbent was adsorbed is fixed stably, while being able to carry out things, It becomes possible to fix used mercury adsorbent in the state where it was stabilized, without causing the insufficient strength of unprepared elution of mercury, or a solidified body, since it can suppress that solidification of a solidifying material is prevented from alkaline lowness.
[0050]The solidifying material which mixes portland cement and blast furnace slag according to the fixing method of the used mercury adsorbent in connection with this invention, Since it is generally cheaply marketed as blast furnace cement and not only the inside of Japan but every country in the world can be obtained easily, it becomes possible to carry out solidification of the used mercury adsorbent simple and cheaply.
[0051]In order for main work to mix [very easy] used mercury adsorbent, a solidifying material, and water according to the fixing method of the used mercury adsorbent in connection with this invention, Even if it is in the petroleum plant which used mercury adsorbent generates, it becomes possible to carry out solidification of the used mercury adsorbent very easily.

[Translation done.]

* NOTICES *

TECHNICAL FIELD

[Field of the Invention]In this invention, it is related with the solidification method of used mercury adsorbent.
In detail Therefore, gaseous hydrocarbon, such as natural gas, or LNG (liquefied natural gas),It is related with the solidification method of the used mercury adsorbent used for the adsorption treatment treatment process of mercury in liquid hydrocarbon, such as NGL (natural gas liquid), kerosene, gas oil, gasoline, and naphtha, especially a natural GASUKONDENSE rate.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

EFFECT OF THE INVENTION

[Effect of the Invention]As mentioned above, as explained in full detail, in the solidification method of the used mercury adsorbent in connection with this invention, solidification of the used mercury adsorbent which adsorbed mercury is carried out using the solidifying material which mixes portland cement and blast furnace slag.
[0049]according to the fixing method of the used mercury adsorbent in connection with this invention, the mercury by which mercury adsorbent was adsorbed is fixed stably, while being able to carry out things, It becomes possible to fix used mercury adsorbent in the state where it was stabilized, without causing the insufficient strength of unprepared elution of mercury, or a solidified body, since it can suppress that solidification of a solidifying material is prevented from alkaline lowness.
[0050]According to the fixing method of the used mercury adsorbent in connection with this invention, generally, the solidifying material which mixes portland cement and blast furnace slag is cheaply marketed as blast furnace cement.
Since not only the inside of Japan but every country in the world can be obtained easily, it becomes possible to carry out solidification of the used mercury adsorbent simple and cheaply.

[0051]In order for main work to mix [very easy] used mercury adsorbent, a solidifying material, and water according to the fixing method of the used mercury adsorbent in connection with this invention, Even if it is in the petroleum plant which used mercury adsorbent generates, it becomes possible to carry out solidification of the used mercury adsorbent very easily.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention]by the way, common poisonous metal -- for example, -- Some methods of carrying out cement solidification processing of Cd (cadmium), Pb (lead), Hg (mercury), the Cr (chromium), etc. are proposed.
[0007]For example, Provisional Publication No. In No. 133578 [53 to] ("solidifying method by cement of chromic compound content waste"). By carrying out addition mixing of hydraulic cement, blast furnace slag powder, ferrous sulfate, or the ferrous chloride, even after hydration of cement advances, the art of acquiring the cement solidification object which is not put to acid conditions and was excellent in airtightness and watertightness is indicated.
[0008]Publication number In No. 10739 [eight to] ("waste treatment material and waste disposal method"). The burned ash waste containing poisonous metal, such as mercury, lead, and cadmium, an acid earth, The art which carries out solidification by bentonite, kaolin, aluminum sulfate, aluminium silicate, the solid acid of a silicon dioxide or this solid acid, cement, and the thing that added the anti-caking agent to this further is indicated considering the elution prevention art of Pb as a center.
[0009]However, since it was an inorganic compound and an organic compound, in order to have processed used mercury adsorbent stably, the conventional cement solidification processing of the chemical form voice of the mercury by which used mercury adsorbent was adsorbed was insufficient.
[0010]That is, in used mercury adsorbent, mercury is adsorbed mainly with the gestalt of mercury sulfide, and while this mercury sulfide is insolubility and has stable character to water, in an oxidizing atmosphere, it shows the character which oxidizes to sulfate and is eluted easily.
[0011]Since a kind of mercury adsorbent has the character which reacts to alkali and is dissolved under a strong-base condition, When the ordinary portland cement in which strong alkali is shown according to a solidification process, and the alkali stimulus solidifying material which uses sodium hydroxide as a stimulant are used, and mercury adsorbent dissolves in a solidification process, there is inconvenience that solidification is checked and intensity is not revealed.
[0012]It is in the purpose of this invention providing the solidification method of used mercury adsorbent which can carry out solidification of the used mercury adsorbent which adsorbed mercury in the state where it was stabilized, in view of the above-mentioned actual condition.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

MEANS

[Means for Solving the Problem]There are few alkali yields produced in a solidification process, and a solidifying material which has the capability to stabilize mercury sulfide because the solidifying material itself shows reduction nature is ideal for controlling a problem in cement solidification processing of the **** former mentioned above.
[0014]An artificer of this application found out that what is called blast furnace cement that mixes portland cement and blast furnace slag was the optimal as a solidifying material with which it is satisfied of conditions like ****.
[0015]So, in a solidification method of used mercury adsorbent in connection with this invention, solidification of the used mercury adsorbent which adsorbed mercury is carried out using a solidifying material which mixes portland cement and blast furnace slag in order to attain the above-mentioned purpose.
[0016]
[Embodiment of the Invention]Drawing 1 shows the example which applied the solidification method of the used mercury adsorbent in connection with this invention to the adsorption treatment treatment process which removes mercury out of a natural GASUKONDENSE rate (NGL).
[0017]As shown in drawing 1, the solidification of used mercury adsorbent includes the process (S2) of kneading the process (S1) of adjusting the moisture regain of used mercury adsorbent, and used mercury adsorbent and a solidifying material, and the process (S2) of feeding the kneaded material of used mercury adsorbent and a solidifying material into a solidification container.
[0018]In order to carry out solidification of the used mercury adsorbent like ****, the moisture regain of the used mercury adsorbent A is adjusted first (S1). The "mercury adsorbent" under following explanation shall point out "used mercury adsorbent."
[0019]Here, when the mercury adsorbent A is dry, the water of the specified quantity is added to this mercury adsorbent A, and when the mercury adsorbent A is immersed in water, the moisture regain of the mercury adsorbent A is adjusted by draining off water to the mercury adsorbent A. At the time of adjustment of this moisture regain, the mercury adsorbent A may still be the fabricated gestalt, or may be ground.
[0020]After adjusting the moisture regain of the mercury adsorbent A, in addition to the mercury adsorbent A with which moisture regain was adjusted, blast furnace cement D as the solidifying material D which mixes blast-furnace-slag B and the portland cement C, or a solidifying material prepared beforehand is kneaded (S2).
[0021]When mixing the solidifying material D with the mercury adsorbent A, the mercury adsorbent A with which moisture regain was adjusted to the cement base (solidifying material) D which added, kneaded and prepared water to the solidifying material D which mixes blast-furnace-slag B and the portland cement C, or blast furnace cement may be added.
[0022]After kneading the mercury adsorbent A and the solidifying material (blast furnace cement) D, this kneaded material is fed into the solidification container (not shown) of specified shape (S3).

After this, by recuperating oneself about one month, solidification of the mercury adsorbent A will be carried out because the mercury adsorbent A and kneaded material with the solidifying material D change with a solidified body.
[0023]As stated also in advance, mercury adsorbent adsorbs mercury as mercury sulfide here, As a method of solidifying so that elution of mercury from hydrogen adsorbent may be controlled and disposal may be suited, application of the cement solidification material which blended blast furnace slag is the optimal, without having the capability to insolubilize and spoiling this capability.
[0024]By namely, the thing for which mercury adsorbent is solidified with the cement which iron and the sulfur component which show reduction nature contain in blast furnace slag, and blended blast furnace slag. Since mercury adsorbent can be solidified in reducing atmosphere, it becomes possible to fix stably with the gestalt of mercury sulfide which is an adsorption gestalt of mercury.
[0025]The mercury adsorbent containing nickel, Co, and Mo, When the solidifying material which generates a lot of [since nickel etc. dissolve under a strong-base condition / when solidifying like portland cement] calcium hydroxide is used, Solidification of cement is checked with the metal which the mercury fixed performance which some mercury adsorbent dissolves and mercury adsorbent has was spoiled, and dissolved. In order to suppress the dissolution of such mercury adsorbent and to generate a stable solidified body, an alkaline low solidifying material is suitable and the cement solidification material which contains blast furnace slag so much is suitable as an alkaline low solidifying material.
[0026]Therefore, according to the fixing method of the used mercury adsorbent in connection with this invention which carries out solidification of the mercury adsorbent using the solidifying material which mixes portland cement and blast furnace slag as mentioned above. It becomes possible to fix used mercury adsorbent in the state where it was stabilized, without causing the insufficient strength of unprepared elution of mercury, or a solidified body, since the thing which fix stably the mercury by which mercury adsorbent was adsorbed and for which solidification of a solidifying material is prevented from alkaline lowness while being able to carry out things can be suppressed.
[0027]Since the solidifying material which mixes portland cement and blast furnace slag is generally cheaply marketed as blast furnace cement and can be easily obtained not only in the inside of Japan but in every country in the world, it becomes possible to carry out solidification of the used mercury adsorbent simple and cheaply.
[0028]In the fixing method of the used mercury adsorbent in connection with this invention, the main work, In order to mix [very easy] used mercury adsorbent, a solidifying material, and water, it becomes possible to carry out solidification of the used mercury adsorbent very easily into the petroleum plant which used mercury adsorbent generates.
[0029]Table 1 indicated to drawing 2 expresses the result of having carried out the elution test, to the solidified body created using various kinds of solidifying materials.
[0030]the so-called pellet of the nickel-Cr-MoX catalyst which made the gamma alumina carrier support nickel, Cr, and Mo sulfide with this examination -- mercury 0.8 wt% -- the thing made to adsorb is made into the sample of mercury adsorbent.
[0031]The comparative examination is carried out about three sorts of solidified bodies and the mercury adsorbent simple substance which were created using these solidifying materials, using an ordinary-portland-cement and blast furnace cement C kind equivalent (portland cement/blast furnace slag = 35/65 wt%) and slag cement as a solidifying material.
[0032]Each solidified body is mercury adsorbent. It is water to 5 g. 9.2 g, solidifying material After adding 17.9 g and mixing, this was supplied to the solidification container, and in the room temperature, care of health was performed for one month, and it created. In using slag cement as a solidifying material, it has also added the sodium hydroxide solution as a hardening agent.
[0033]The elution test was carried out according to the "assaying method of metal etc. which are contained in industrial waste" Environment-Protection-Agency notification No. (February, Showa 48) 13. That is, a sample is extracted from liquid after grinding the created solidified body and

shaking in weak chloride aqueous acids for ordinary temperature 6 hours, and this sample is quantified by hydride generation atomic absorption spectrophotometry.
[0034]The solidified body using blast furnace cement as a solidifying material has the low mercury concentration in an eluate compared with a mercury adsorbent simple substance, and it is clear from the test result of Table 1 that its elution of mercury is controlled by solidification.
[0035]On the other hand, in the solidified body using portland cement as a solidifying material, and the solidified body using slag cement as a solidifying material, the phenomenon in which elution of mercury will be promoted conversely is seen compared with a mercury adsorbent simple substance.
[0036]On the other hand, it turns out that the oxidation-reduction potential of the eluate shows the low value in the solidified body which used blast furnace cement and slag cement as the solidifying material, and these solidified bodies show reduction nature.
[0037]However, although the solidified body which used slag cement as the solidifying material has a low oxidation-reduction potential, since the sodium hydroxide solution is added as a hardening agent, the dissolution of mercury adsorbent arises, and it does not solidify thoroughly, but, therefore, the elution depressor effect of mercury will become small.
[0038]When used mercury adsorbent is fixed from this result, controlling elution of mercury effectively, it turns out that use of the solidifying material which blends portland cement and blast furnace slag is the optimal.
[0039]Table 2 indicated to drawing 3 expresses the result of having carried out the elution test, to the solidified body created using the various solidifying materials which changed the mixture ratio of portland cement and blast furnace slag.
[0040]In this examination, the chemical form voice of the mercury by which mercury adsorbent was adsorbed is imitated, and the powder of mercury sulfide is used as a sample.
[0041]What mixed three sorts of blast furnace slag from which a maker differs, and portland cement by various kinds of weight ratios of 5/95, 10/90, 20/80, 40/60, 65/35, and 80/20 is used as a solidifying material.
[0042]In a solidified body and water of 14.3 g A 35.7-g solidifying material is added, and it mixes, and is this. After adding 0.058-g mercury sulfide powder and mixing, it is creating by supplying to a solidification container and recuperating oneself.
[0043]According to the "assaying method of metal etc. which are contained in industrial waste" Environment-Protection-Agency notification No. (February, Showa 48) 13, an elution test as well as the examination which showed the result in Table 1, A sample is extracted from liquid after grinding the created solidified body and shaking in weak chloride aqueous acids for ordinary temperature 6 hours, and this sample is quantified by hydride generation atomic absorption spectrophotometry.
[0044]The mercury concentration in the eluate in each solidified body is not based on the difference in the maker of blast furnace slag, but shows the almost same measured value so that clearly from Table 2. It turns out that it is what is revealed based on the physical properties with which the fixed effect of mercury in the solidifying material having contained blast furnace slag is not based on a specific kind of blast furnace slag, and blast furnace slag is generally provided from this.
[0045]When the blending ratio of blast furnace slag to portland cement uses a low solidifying material, Although the tendency for the elution volume of mercury to increase is seen, the blending ratio of blast furnace slag and portland cement is a weight ratio. In 10/90 - 80/20, the elution volume of mercury shows the low value.
[0046]As a result, when used mercury adsorbent is fixed controlling elution of mercury effectively, the blending ratio of blast furnace slag and portland cement is a weight ratio. It turns out that the solidifying material in the range of 10 / 90 - 80/20 can be used.
[0047]The solidification method of the mercury adsorbent in connection with this invention, Only not only in the adsorption treatment treatment process which removes mercury out of a natural GASUKONDENSE rate (NGL), Also when removing mercury out of liquid hydrocarbon, such as gaseous hydrocarbon, such as natural gas, LNG (liquefied natural gas), kerosene, gas oil, gasoline,

naphtha, it cannot be overemphasized that it can apply very effectively.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]The work-flows figure showing the solidification method of the used mercury adsorbent in connection with this invention.
[Drawing 2]The table 1 showing the result of having carried out the elution test to the solidified body created using various kinds of solidifying materials.
[Drawing 3]The table 2 showing the result of having carried out the elution test to the solidified body created using the various solidifying materials which changed the mixing ratio of portland cement and blast furnace slag.
[Description of Notations]
A -- Used mercury adsorbent,
B -- Portland cement,
C -- Blast furnace slag
D -- A solidifying material, blast furnace cement.

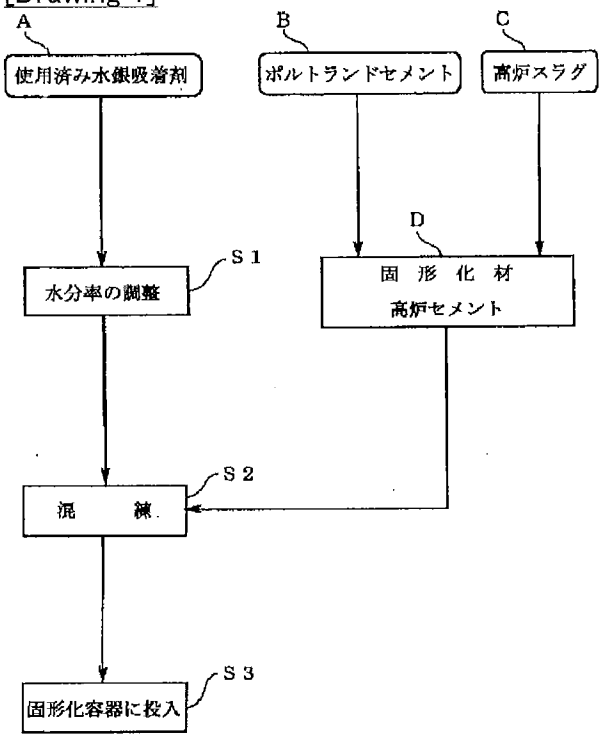
[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

[Drawing 1]



[Drawing 2]

表 1

固化体（固化材）	溶出液中の水銀濃度	溶出液の酸化還元電位
水銀吸着剤単体	1．5 ppb	Eh ＝ 140 mV
ポルトラントセメント	16．5 ppm	Eh ＝ 50 mV
高炉セメント	＜0．5 ppb	Eh ＝ -93 mV
スラグセメント	145 ppb	Eh ＝ -106 mV

[Drawing 3]

表 2

固化体（固化材） （高炉ｽﾗｸﾞ/ﾎﾟﾙﾄﾗﾝﾄﾞｾﾒﾝﾄ 比）	高炉スラグ メーカー	溶出液中の 水銀濃度（ppm）
5／95（wt%）	A社	15
10／90（wt%）	A社	1
20／80（wt%）	A社	0．5
	B社	＜0．1
	C社	＜0．1
40／60（wt%）	A社	0．3
	B社	＜0．1
	C社	＜0．1
65／35（wt%）	A社	＜0．1
	B社	＜0．1
	C社	＜0．1
80／20（wt%）	A社	＜0．1

[Translation done.]

© EPODOC / EPO

PN - JP11347516 A 19991221
TI - METHOD FOR SOLIDIFICATION TREATMENT OF USED MERCURY ADSORBENT
FI - B09B3/00+ZAB ; B09B3/00&301K ; B09B3/00&301S ; C04B7/19
PA - JGC CORP
IN - SASAKI TADASHI; SATO KAZUO; FUJIMURA YASUSHI; YAMADA MASATOSHI
AP - JP19980162180 19980610
PR - JP19980162180 19980610
DT - I

© WPI / DERWENT

AN - 2000-110248 [10]
TI - Solidification processing of used absorbent for mercury in liquid and gaseous hydrocarbon compounds - involves using mixture of portland cement and blast furnace slag as solidification material
AB - JP11347516 NOVELTY - The solidification material for absorbing portland, contains a mixture of used mercury cement and blast furnace slag.
- USE - For solidification of used absorbent of mercury in liquid and gaseous hydrocarbons such as liquid natural gas, natural gas liquid, kerosene, light oil, gasoline, naphtha etc.
- ADVANTAGE - Solidification of used absorbent of mercury is carried out cheaply.
- (Dwg.0/3)
IW - SOLIDIFICATION PROCESS ABSORB MERCURY LIQUID GAS HYDROCARBON COMPOUND MIXTURE PORTLAND CEMENT BLAST FURNACE SLAG SOLIDIFICATION MATERIAL
PN - JP11347516 A 19991221 DW200010 B09B3/00 005pp
IC - B09B3/00 ;C04B7/19
PA - (JAGA) JGC CORP

© PAJ / JPO

PN - JP11347516 A 19991221
TI - METHOD FOR SOLIDIFICATION TREATMENT OF USED MERCURY ADSORBENT
AB - PROBLEM TO BE SOLVED: To solidify a used mercury adsorbent in a stabilized state by solidifying a used mercury adsorbent having adsorbed mercury, using a solidifying material composed of a mixture of Portland cement with blastfurance slag.
- SOLUTION: In the case of solidification treatment of a used mercury adsorbent A having been used in an adsorption removal treatment process of mercury in a natural gas condensate, at first a water content rate of the used mercury adsorbent A is adjusted. In the case where the mercury adsorbent A is dry in this case, a specific amount of water is added, and further when the mercury adsorbent A is dipped in water, draining is executed. Then, a solidifying material D prepared by mixing a granulated blast furnace slag C, a Portland cement B or a previously prepared blast furnace cement D as the solidifying material is added to the marcury adsorbent A, and kneaded. After kneading, the kneaded material is charged into a solidification container and allowed to make a solidified material by curing for about one month. Further, a formulation ratio of the blastfurnace slag C and the Portland cement B is preferably in the range of 10/90 to 80/20 in wt. ratio.
I - B09B3/00 ;B09B3/00
SI - C04B7/19
PA - JGC CORP
IN - FUJIMURA YASUSHI;SASAKI TADASHI;YAMADA MASATOSHI;SATO KAZUO
ABD - 20000330
ABV - 200003
AP - JP19980162180 19980610
PD - 1999-12-21

(19)日本国特許庁（ＪＰ）　(12) 公開特許公報（A）　(11)特許出願公開番号

特開平11－347516

(43)公開日　平成11年(1999)12月21日

(51)Int.Cl.[6]	識別記号	FI	
B09B 3/00		B09B 3/00	301K
	ZAB	C04B 7/19	
// C04B 7/19		B09B 3/00	ZAB
			301S

審査請求　未請求　請求項の数2　OL　（全 5 頁）

(21)出願番号　特願平10－162180

(22)出願日　平成10年(1998)6月10日

(71)出願人　000004411
日揮株式会社
東京都千代田区大手町２丁目２番１号

(72)発明者　藤村　靖
茨城県東茨城郡大洗町成田町2205　日揮株式会社技術研究所内

(72)発明者　佐々木　忠志
茨城県東茨城郡大洗町成田町2205　日揮株式会社技術研究所内

(72)発明者　山田　正年
愛知県半田市州の崎町２－110　日揮株式会社衣浦研究所内

(74)代理人　弁理士　木村　高久

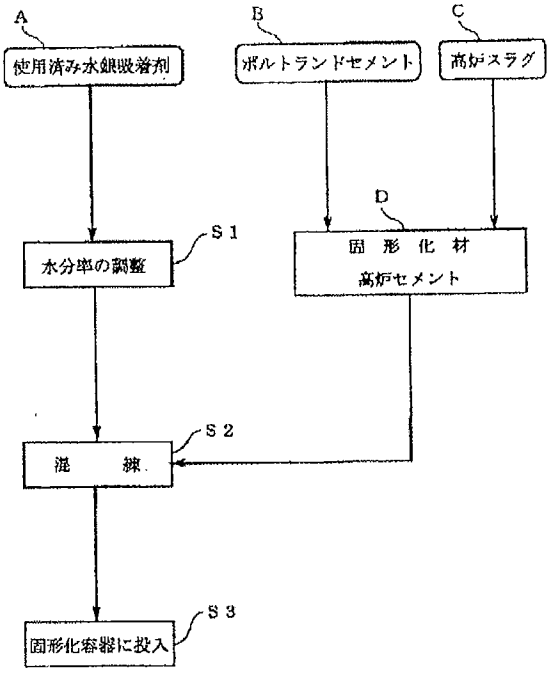
最終頁に続く

(54)【発明の名称】　使用済み水銀吸着剤の固化処理方法

(57)【要約】

【課題】　本発明の課題は、水銀を吸着した使用済みの水銀吸着剤を、水銀の溶出を抑制して安定に固化処理することの可能な、使用済み水銀吸着剤の固化処理方法を提供することにある。

【解決手段】　本発明に関わる使用済み水銀吸着剤の固化処理方法は、ポルトランドセメントと高炉スラグとを混合して成る固化材を用いて、水銀を吸着した使用済み水銀吸着剤を固化処理している。



1

【特許請求の範囲】

【請求項１】　ポルトランドセメントと高炉スラグとを混合して成る固化材を用いて、水銀を吸着した使用済み水銀吸着剤を固化処理することを特徴とする使用済み水銀吸着剤の固化処理方法。

【請求項２】　固化材を構成する高炉スラグとポルトランドセメントとの配合割合を、重量比で１０／９０～８０／２０の範囲としたことを特徴とする請求項１記載の使用済み水銀吸着剤の固化処理方法。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、使用済み水銀吸着剤の固化処理方法に関するもので、詳しくは、天然ガス等のガス状炭化水素、あるいはＬＮＧ(液化天然ガス)、ＮＧＬ(天然ガスリキッド)、灯油、軽油、ガソリン、ナフサ等の液状炭化水素、特に天然ガスコンデンセレート中の水銀の吸着除去処理プロセスに用いられた使用済みの水銀吸着剤の固化処理方法に関する。

【０００２】

【従来の技術】天然ガスや天然ガスリキッド(ＮＧＬ)等に含まれている水銀は、アルミニウム製熱交換器の腐食や、触媒の性能劣化の問題がある。

【０００３】そこで、天然ガスや天然ガスリキッド等に含まれている水銀を、水銀吸着剤を用いて吸着除去する技術が提供されている。

【０００４】水銀吸着剤には、アルミナ担持体にＮｉ(ニッケル)、Ｃｏ(コバルト)、Ｍｏ(モリブデン)硫化物を添加したもの、活性炭単独から成るもの、さらには活性炭単体に硫化アルカリ金属や硫化アルカリ土類金属を担持したもの等がある。

【０００５】一方、水銀を吸着した後の水銀吸着剤は、水銀を含んだ有害な廃棄物であるため、安全な方法で処理しなければならない。使用済み水銀吸着剤も、乾電池や蛍光灯等と同様、加熱により水銀蒸気として追い出したあと、凝縮させて金属水銀として処理する方法が安全である。しかし、日本には僅かしか処理設備がなく、また世界的に見てもその数は少なく、特に東南アジア等では皆無である。これは処理設備が高価なこと、および設備の運転管理が難しいことによる。この方法に代わるものとして、セメント等で固形化して適切に処分する方法が挙げられる。

【０００６】

【発明が解決しようとする課題】ところで、一般的な有害金属、例えばＣｄ(カドミウム)、Ｐｂ(鉛)、Ｈｇ(水銀)、Ｃｒ(クロム)等を、セメント固化処理する方法が幾つか提案されている。

【０００７】例えば、特開昭 53-133578号(「三価クロム化合物含有廃棄物のセメントによる固化方法」)には、水硬性セメントと高炉水滓スラグ粉末と硫酸第一鉄もしくは塩化第一鉄とを添加混合することにより、セメントの水和が進行した後も酸性条件に曝されることがなく気密性、水密性に優れたセメント固化体を得る技術が開示されている。

2

【０００８】また、特開平 8-10739号(「廃棄物処理材及び廃棄物処理方法」)には、水銀、鉛、カドミウム等の有害金属を含有する焼却灰廃棄物を、酸性白土、ベントナイト、カオリン、硫酸アルミニウム、アルミニウムシリケート、または二酸化珪素の固体酸、または該固体酸とセメント、さらにこれに固結防止剤を加えたものにより固化処理する技術が、Ｐｂの溶出防止技術を中心として開示されている。

【０００９】しかしながら、使用済み水銀吸着剤に吸着された水銀の化学形態は、無機化合物や有機化合物であるため、使用済み水銀吸着剤を安定に処理するには、従来のセメント固化処理では不十分であった。

【００１０】すなわち、使用済みの水銀吸着剤において、水銀は主として硫化水銀の形態で吸着されており、この硫化水銀は水に対して不溶性で、安定な性質を有している反面、酸化雰囲気においては、硫酸塩に酸化されて溶出し易い性質を示す。

【００１１】また、水銀吸着剤の一種は、強アルカリ条件下においてアルカリと反応して溶解する性質を有するため、固化過程で強いアルカリを示す普通ポルトランドセメントや、水酸化ナトリウムを刺激剤として使用するアルカリ刺激固化材を使用した場合、固化過程において水銀吸着剤が溶解することにより、固化が阻害されて強度が発現しないという不都合が有る。

【００１２】本発明の目的は上記実状に鑑みて、水銀を吸着した使用済みの水銀吸着剤を、安定した状態で固化処理することの可能な、使用済み水銀吸着剤の固化処理方法を提供することにある。

【００１３】

【課題を解決するための手段】上述した如き従来のセメント固化処理における問題を抑制するには、固化過程で生じるアルカリ発生量が少なく、固化材自体が還元性を示すことで硫化水銀を安定化させる能力を有する固化材が最適である。

【００１４】本願の発明者は、上述の如き条件を満足する固化材として、ポルトランドセメントと高炉スラグとを混合して成る、いわゆる高炉セメントが最適であることを見出した。

【００１５】そこで、本発明に関わる使用済み水銀吸着剤の固化処理方法では、上記目的を達成するべく、ポルトランドセメントと高炉スラグとを混合して成る固化材を用いて、水銀を吸着した使用済み水銀吸着剤を固化処理している。

【００１６】

【発明の実施の形態】図１は、天然ガスコンデンセレート(ＮＧＬ)中から水銀を除去する吸着除去処理プロセスに、本発明に関わる使用済み水銀吸着剤の固化処理方法

3

を適用した例を示している。

【0017】図1に示すように、使用済み水銀吸着剤の固化処理は、使用済み水銀吸着剤の水分率を調整する工程(S1)と、使用済み水銀吸着剤と固化材とを混練する工程(S2)と、使用済み水銀吸着剤と固化材との混練物を固形化容器に投入する工程(S2)とを含んでいる。

【0018】上述の如く、使用済み水銀吸着剤を固化処理するには、先ず使用済み水銀吸着剤Aの水分率を調整する(S1)。なお、以下の説明中における「水銀吸着剤」は、「使用済み水銀吸着剤」を指すものとする。

【0019】ここで、水銀吸着剤Aが乾燥している場合には、この水銀吸着剤Aに所定量の水を加え、水銀吸着剤Aが水に浸漬されている場合には、水銀吸着剤Aに対して水切りを行うことで、水銀吸着剤Aの水分率を調整する。なお、この水分率の調整時において、水銀吸着剤Aは成形された形態のままであっても、あるいは粉砕したものであっても良い。

【0020】水銀吸着剤Aの水分率を調整したのち、高炉スラグBとポルトランドセメントCとを混合して成る固化材D、あるいは予め調製された固化材としての高炉セメントDを、水分率の調整された水銀吸着剤Aに加えて混練する(S2)。

【0021】なお、水銀吸着剤Aと固化材Dとを混合する際、高炉スラグBとポルトランドセメントCとを混合して成る固化材D、あるいは高炉セメントに水を加え混練して調製したセメントベース(固化材)Dに、水分率の調整された水銀吸着剤Aを加えても良い。

【0022】水銀吸着剤Aと固化材(高炉セメント)Dとを混練したのち、この混練物を所定形状の固形化容器(図示せず)に投入する(S3)。こののち、1ヶ月程度養生することによって、水銀吸着剤Aと固化材Dとの混練物が固化体と成ることで、水銀吸着剤Aが固化処理されることとなる。

【0023】ここで、先にも述べたように、水銀吸着剤は水銀を硫化水銀として吸着し、不溶化する能力を有しており、この能力を損なうことなく、水素吸着剤からの水銀の溶出を抑制し、処分に適合するように固形化する方法としては、高炉スラグを配合したセメント固化材の適用が最適である。

【0024】すなわち、高炉スラグには還元性を示す鉄や硫黄成分が含有されており、高炉スラグを配合したセメントによって水銀吸着剤を固形化することで、水銀吸着剤を還元雰囲気中に固形化できるため、水銀の吸着形態である硫化水銀の形態のままで安定に固定化することが可能となる。

【0025】また、Ni、Co、Moを含む水銀吸着剤は、強アルカリ条件下においてNi等が溶解するため、ポルトランドセメントの如く固化する際に大量の水酸化カルシウムを生成する固化材を使用した場合、水銀吸着剤の一部が溶解して水銀吸着剤の持つ水銀固定化性能が

4

損なわれ、かつ溶解した金属によってセメントの固化が阻害される。このような水銀吸着剤の溶解を抑え、安定な固化体を生成するためには、アルカリ性の低い固化材が適切であり、高炉スラグを多量に含むセメント固化材は、アルカリ性の低い固化材として適切である。

【0026】したがって、上述した如くポルトランドセメントと高炉スラグとを混合して成る固化材を用いて水銀吸着剤を固化処理する、本発明に関わる使用済み水銀吸着剤の固定化方法によれば、水銀吸着剤に吸着された水銀を安定に固定化することできるとともに、アルカリ性の低さから固化材の固化が阻害されることを抑えられるので、水銀の不用意な溶出や固化体の強度不足を招くことなく、使用済みの水銀吸着剤を安定した状態で固定化することが可能となる。

【0027】また、ポルトランドセメントと高炉スラグとを混合して成る固化材は、一般に高炉セメントとして安価に市販されており、日本国内に限らず世界各国でも容易に入手できるので、簡便かつ安価に使用済み水銀吸着剤を固化処理することが可能となる。

【0028】さらに、本発明に関わる使用済み水銀吸着剤の固定化方法において、その主たる作業は、使用済み水銀吸着剤と固化材および水とを混合するという極めて簡単なものであるため、使用済みの水銀吸着剤が発生する石油プラント内において、使用済み水銀吸着剤を極めて容易に固化処理することが可能となる。

【0029】図2に開示した表1は、各種の固化材を用いて作成した固化体に対し、溶出試験を実施した結果を表している。

【0030】この試験では、ガンマアルミナ担体にNi、Cr、Mo硫化物を担持させた、いわゆるNi-Cr-Mo X 触媒のペレットに、水銀を 0.8 wt%吸着させたものを、水銀吸着剤の試料としている。

【0031】また、固化材として普通ポルトランドセメント、高炉セメントC種相当品(ポルトランドセメント/高炉スラグ= 35/65 wt%)、スラグセメントを用い、これら固化材を用いて作成した3種の固化体と水銀吸着剤単体とについて比較検討している。

【0032】各々の固化体は、水銀吸着剤 5gに対して、水 9.2g、固化材 17.9gを加えて混合した後、これを固形化容器に投入し、室温において1ヶ月養生を行って作成した。なお、固化材としてスラグセメントを用いる場合には、硬化剤として水酸化ナトリウム溶液も添加している。

【0033】また、溶出試験は「産業廃棄物に含まれる金属等の検定方法」環境庁告示13号(昭和48年2月)に従って実施した。すなわち、作成した固化体を粉砕して弱塩酸酸性水溶液中で常温6時間振盪した後の液から試料を採取し、この試料を還元気化原子吸光光度法によって定量している。

【0034】表1の試験結果から、固化材として高炉セ

5

メントを用いた固化体は、水銀吸着剤単体に比べて溶出液中の水銀濃度が低く、固化処理によって水銀の溶出が抑制されていることは明らかである。

【００３５】これに対して、固化材としてポルトランドセメントを用いた固化体、および固化材としてスラグセメントを用いた固化体では、水銀吸着剤単体に比べて、逆に水銀の溶出が促進されてしまう現象が見られる。

【００３６】一方、溶出液の酸化還元電位は、高炉セメントおよびスラグセメントを固化材とした固化体において低い値を示しており、これらの固化体が還元性を示していることが分かる。

【００３７】しかし、スラグセメントを固化材とした固化体は酸化還元電位が低いものの、硬化剤として水酸化ナトリウム溶液が添加されているため、水銀吸着剤の溶解が生じて完全には固化せず、よって水銀の溶出抑制効果は小さなものとなる。

【００３８】この結果から、水銀の溶出を効果的に抑制しつつ使用済み水銀吸着剤を固定化する上で、ポルトランドセメントと高炉スラグを配合して成る固化材の使用が最適であることが分かる。

【００３９】図３に開示した表２は、ポルトランドセメントと高炉スラグとの混合比を変えた各種固化材を用いて作成した固化体に対し、溶出試験を実施した結果を表している。

【００４０】この試験では、水銀吸着剤に吸着された水銀の化学形態を模擬し、試料として硫化水銀の粉末を使用している。

【００４１】また、固化材として、メーカーの異なる高炉スラグ３種と、ポルトランドセメントとを、5／95、10／90、20／80、40／60、65／35、80／20 の各種の重量比で混合したものを用いている。

【００４２】固化体は、 14.3ｇの水に 35.7ｇの固化材を加えて混合し、これに 0.058ｇの硫化水銀粉末を加えて混合したのち、固形化容器に投入して養生することにより作成している。

【００４３】溶出試験は、表１に結果を示した試験と同じく「産業廃棄物に含まれる金属等の検定方法」環境庁告示１３号（昭和４８年２月）に従い、作成した固化体を粉砕して弱塩酸酸性水溶液中で常温６時間振盪した後の液から試料を採取し、この試料を還元気化原子吸光光度法により定量している。

【００４４】表２から明らかなように、各々の固化体における溶出液中の水銀濃度は、高炉スラグのメーカーの違いによらず、ほぼ同様の測定値を示している。このことから、高炉スラグを含んだ固化材における水銀の固定化効果が、特定な種類の高炉スラグに因るものではなく、高炉スラグが一般的に備えている物性に基づいて発現するものであることが分かる。

【００４５】また、ポルトランドセメントに対する高炉スラグの配合割合が低い固化材を用いた場合、水銀の溶

6

出量が増大する傾向が見られるものの、高炉スラグとポルトランドセメントとの配合割合が重量比で 10／90 ～ 80／20 の範囲では、水銀の溶出量が低い値を示している。

【００４６】この結果、水銀の溶出を効果的に抑制しつつ使用済み水銀吸着剤を固定化する上で、高炉スラグとポルトランドセメントとの配合割合が、重量比で 10／90～ 80／20 の範囲にある固化材を使用し得ることが分かる。

【００４７】なお、本発明に関わる水銀吸着剤の固化処理方法は、天然ガスコンデンセレート（ＮＧＬ）中から水銀を除去する吸着除去処理プロセスのみならず、天然ガス等のガス状炭化水素や、ＬＮＧ（液化天然ガス）、灯油、軽油、ガソリン、ナフサ等の液状炭化水素中から水銀を除去する場合にも、極めて有効に適用し得ることは言うまでもない。

【００４８】

【発明の効果】以上、詳述した如く、本発明に関わる使用済み水銀吸着剤の固化処理方法では、ポルトランドセメントと高炉スラグとを混合して成る固化材を用いて、水銀を吸着した使用済み水銀吸着剤を固化処理している。

【００４９】本発明に関わる使用済み水銀吸着剤の固定化方法によれば、水銀吸着剤に吸着された水銀を安定に固定化することできるとともに、アルカリ性の低さから固化材の固化が阻害されることを抑えられるので、水銀の不用意な溶出や固化体の強度不足を招くことなく、使用済みの水銀吸着剤を安定した状態で固定化することが可能となる。

【００５０】また、本発明に関わる使用済み水銀吸着剤の固定化方法によれば、ポルトランドセメントと高炉スラグとを混合して成る固化材は、一般に高炉セメントとして安価に市販されており、日本国内に限らず世界各国でも容易に入手できるので、簡便かつ安価に使用済み水銀吸着剤を固化処理することが可能となる。

【００５１】さらに、本発明に関わる使用済み水銀吸着剤の固定化方法によれば、主たる作業は使用済み水銀吸着剤と固化材および水とを混合するという極めて簡単なものであるため、使用済みの水銀吸着剤が発生する石油プラント内であっても、使用済み水銀吸着剤を極めて容易に固化処理することが可能となる。

【図面の簡単な説明】

【図１】本発明に関わる使用済み水銀吸着剤の固化処理方法を示す作業フロー図。

【図２】各種の固化材を用いて作成した固化体に対し溶出試験を実施した結果を示す表１。

【図３】ポルトランドセメントと高炉スラグとの混合割合を変えた各種固化材を用いて作成した固化体に対し溶出試験を実施した結果を示す表２。

【符号の説明】

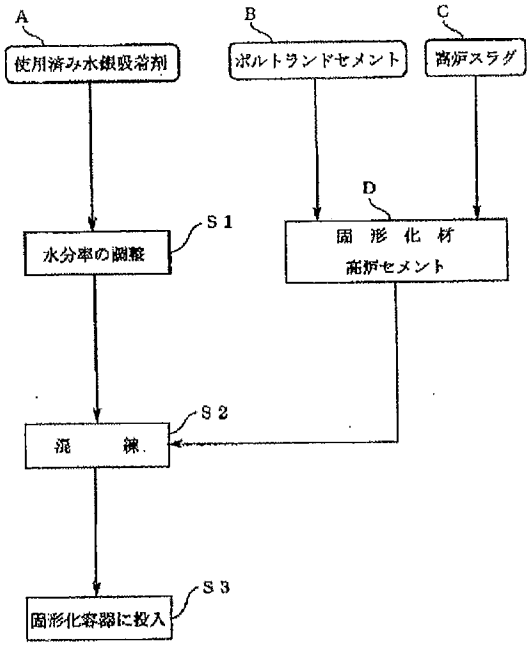
7

A…使用済み水銀吸着剤、
B…ポルトランドセメント、

8

C…高炉スラグ、
D…固化材、高炉セメント。

【図1】



【図2】

表 1

固化体（固化材）	溶出液中の水銀濃度	溶出液の酸化還元電位
水銀吸着剤単体	1．5 ppb	Eh ＝ 140 mV
ポルトラントセメント	16．5 ppm	Eh ＝ 50 mV
高炉セメント	＜0．5 ppb	Eh ＝ -93 mV
スラグセメント	145 ppb	Eh ＝ -106 mV

【図3】

表 2

固化体（固化材） （高炉ｽﾗｸﾞ/ﾎﾟﾙﾄﾗﾝﾄﾞｾﾒﾝﾄ 比）	高炉スラグ メーカー	溶出液中の 水銀濃度（ppm）
5／95（wt%）	A社	15
10／90（wt%）	A社	1
20／80（wt%）	A社	0．5
	B社	＜0．1
	C社	＜0．1
40／60（wt%）	A社	0．3
	B社	＜0．1
	C社	＜0．1
65／35（wt%）	A社	＜0．1
	B社	＜0．1
	C社	＜0．1
80／20（wt%）	A社	＜0．1

フロントページの続き

(72)発明者　佐藤　一夫
愛知県半田市州の崎町２－110　日揮株式
会社衣浦研究所内